

Exploratory Research on Engineering the Service Sector (ESS)

NSF 02-029

Program Announcement

NSF 02-029

DIVISION OF DESIGN, MANUFACTURE, AND INDUSTRIAL INNOVATION
DIRECTORATE FOR ENGINEERING
DIVISION OF BIOENGINEERING AND ENVIRONMENTAL SYSTEMS
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DIVISION OF MATHEMATICAL SCIENCES
DIRECTORATE FOR SOCIAL, BEHAVIORAL, AND ECONOMIC SCIENCES
DIVISION OF SOCIAL AND ECONOMIC SCIENCES

FULL PROPOSAL DEADLINE(S): March 5, 2002



NATIONAL SCIENCE FOUNDATION



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SUMMARY OF PROGRAM REQUIREMENTS

GENERAL INFORMATION

Program Title: Exploratory Research on Engineering the Service Sector (ESS)

Synopsis of Program:

The National Science Foundation announces a focused solicitation for *Exploratory Research on Engineering the Service Sector (ESS)*. The service sector of the U.S. economy dominates both GDP and employment, and provides critical infrastructure on which much of the nation depends. The goal of this ESS effort is to stimulate the development of a community of academic researchers in engineering and allied branches of the mathematical and social sciences, and a corresponding body of research findings, that address the service sector across a scope commensurate with its critical and dominant position. Specifically, this effort will support research on application of the rigorous computational problem-solving techniques that define engineering to improving the quality, productivity, safety, reliability and competitiveness of service operations. The research will thus explore opportunities for extending engineering-oriented research to newly emerging types of service enterprises and to those where it has been relatively under-utilized, seek out new ideas on more established service engineering research topics, and begin building an understanding of issues and opportunities common to different types of service operations.

Cognizant Program Officer(s):

- Ronald L. Rardin, Operations Research & Service Enterprise Engineering, Program Director, Engineering, Design, Manufacture & Industrial Innovation, 550, telephone: 703-292-7081, e-mail: rrardin@nsf.gov.
- Miriam Heller, Infrastructure & Information Systems, Program Director, Engineering, Civil & Mechanical Systems, 545, telephone: 703-292-7025, e-mail: mheller@nsf.gov.
- Gilbert B. Devey, Biomedical Engineering, Program Director, Engineering, Bioengineering & Environmental Systems, 565, telephone: 703-292-7943, e-mail: gdevey@nsf.gov.
- Deborah Frisch, Decision Risk & Management Science, Program Director, Social, Behavioral & Economic Sciences, Social and Economic Sciences, 995, telephone: 703-292-7261, e-mail: dfrisch@nsf.gov.

- Deborah Lockhart, Applied Mathematics, Program Director, Mathematics & Physical Sciences, Mathematical Sciences, 1025, telephone: 703-292-4858, e-mail: dlockhar@nsf.gov.
- Tom Fogwell, Applied Mathematics & Computational Mathematics, Program Director, Mathematics & Physical Sciences, Mathematical Sciences, 1025, telephone: 703-292-8104, e-mail: tfogwell@nsf.gov.
- Marianthi Markatou, Statistics & Probability, Program Director, Mathematics & Physical Sciences, Mathematical Sciences, 1025, telephone: 703-292-4863, e-mail: mmarkato@nsf.gov.

Applicable Catalog of Federal Domestic Assistance (CFDA) Number(s):

- 47.041 --- Engineering
- 47.049 --- Mathematical and Physical Sciences
- 47.075 --- Social, Behavioral and Economic Sciences

ELIGIBILITY INFORMATION

- **Organization Limit:** Proposals may be submitted by U.S. academic institutions eligible under the NSF *Grant Proposal Guide* (http://www.nsf.gov/pubs/2001/nsf012/nsf0102_1.html#whomaysubmit) in support of individual investigators or small groups. Synergistic partnerships with industries and related institutions are encouraged when appropriate; however, NSF awards will be made only to U.S. academic institutions.
- **PI Eligibility Limit:** None
- **Limit on Number of Proposals:** Only one proposal may be submitted by any researcher as Principal Investigator. In addition, the Principal Investigator for one proposal may be co-Principal Investigator on at most one other. Collaborative proposals from researchers at two institutions planning to work jointly on proposed research are allowed.

AWARD INFORMATION

- **Anticipated Type of Award:** Standard Grant
- **Estimated Number of Awards:** 24
- **Anticipated Funding Amount:** \$3.0 million, pending the availability in FY2002 of funds. Awards are limited to standard grants of no more than \$100K (\$150K for investigator teams) for 18 months

PROPOSAL PREPARATION AND SUBMISSION INSTRUCTIONS

A. Proposal Preparation Instructions

- **Full Proposals:** Standard Preparation Guidelines
 - Standard GPG Guidelines apply.

B. Budgetary Information

- **Cost Sharing Requirements:** Cost Sharing is not required.
- **Indirect Cost (F&A) Limitations:** Not Applicable.
- **Other Budgetary Limitations:** Not Applicable.

C. Deadline/Target Dates

- **Letters of Intent (*optional*):** None
- **Preliminary Proposals (*optional*):** None
- **Full Proposal Deadline Date(s):** March 5, 2002

D. FastLane Requirements

- **FastLane Submission:** Required
- **FastLane Contact(s):** None Specified.

PROPOSAL REVIEW INFORMATION

- **Merit Review Criteria:** National Science Board approved criteria apply.

AWARD ADMINISTRATION INFORMATION

- **Award Conditions:** Standard NSF award conditions apply.
- **Reporting Requirements:** Standard NSF reporting requirements apply.

I. INTRODUCTION

The service sector of the United States economy dominates both Gross Domestic Product (GDP) and employment. It is also the fastest growing part of the economy, and the one offering the most fertile opportunities for productivity improvement. For example, service activities now approach 80% of U.S. employment, far outstripping sectors like manufacturing (14%) and agriculture (2%). One service industry alone, health care, constitutes 14-15% of GDP when all its dimensions are included. A decade of decline in the 1970's followed the ten-fold growth in real GDP per labor hour over the prior century, but intensive research and development efforts through the 1980's and 1990's (some of them aided by NSF-funded research) restored manufacturing productivity growth to a healthy 4.5% per year. Still, overall non-farm productivity has continued to decline because of the increasing dominance of service sector employment where recent annual productivity growth has been estimated as low as 0.5%.

The mere scale of the service sector makes it a critical element of the U.S. economy, employing, as it does, many millions of workers producing trillions of dollars in economic value. However, secure and reliable U.S. services provide much of the key infrastructure on which the whole nation, and indeed much of the world's commerce depends. For example, disruptions of transportation industries following terrorist attacks on September 11, 2001 have devastated not only the companies directly involved and their employees, but other elements of the economy ranging from hotels, restaurants and tourist attractions to global supply chain and lean manufacturing systems dependent on just-in-time arrival of parts and components. Tremendous new challenges have arisen as changes in processes and operations are evolved to better assure the safety and reliability of critical services.

Engineering and allied branches of the mathematical and social sciences have made contributions in virtually every service sector, and engineering is pervasive in some fields. Notable examples of the latter are transportation, logistics, and public utility and infrastructure systems. In other sectors, such as finance/insurance, engineering approaches have been broadly applied in private enterprises, but a corresponding academic engineering research community has not fully evolved to integrate results into an expanding and teachable body of knowledge. Furthermore, many critical and growing service sectors such as health care delivery, retail, and hospitality/entertainment have gone mostly overlooked. Finally, new service activities are continually emerging throughout the economy as forces like globalization, e-commerce, and environmental/reuse concerns produce ever more decentralization and outsourcing of operations and processes.

Movement toward an engineering and science research effort commensurate with the breadth and importance of the service sectors in the U.S. economy requires more than just straight-forward extension of ideas and tools developed for other sectors. Fundamentally new issues are posed by unique features of service enterprises:

- Services are generally intangible. They have sometimes been defined as anything of economic value that cannot be held or touched.
- It is usually impossible to build inventories of services. Either the demand for the service must be backlogged or enough resources need to be provided to meet an acceptable fraction of the demand as it arises.

- Services are more dynamic and demand-responsive than manufactured products. This means variability and risk are more central issues in service industries. Indeed, management of financial risk is an important service in itself.
- Many services (examples are medical treatment and equipment repair) require a diagnostic step to design the service as part of its delivery. Co-production, i.e., active collaboration between the server and the customer, is also required in many settings.
- Service products are usually less standardized and less subject to design specifications than manufactured goods because the outputs are tailored to customer needs as they are delivered. This also makes it harder to distinguish service product design from product manufacture and delivery.
- The dimensions of service quality are more subtle and subjective than with physical products. Not only are the parameters of services more difficult to express, but customer perceptions play a much greater role in deciding what is satisfactory or valuable.
- Most service operations are more labor-intensive than goods industries.
- Compared to goods industries, a much greater fraction of the service economy is operated by governments and institutions.
- Information technology is central in service industries. Often it is the only significant equipment available to multiply human output.

Beginning with a workshop held July 23-24, 2001 (see http://www.isye.gatech.edu/nsf_workshop/), NSF is undertaking an effort to stimulate the development of a community of academic researchers in engineering and allied branches of the mathematical and social sciences, and a corresponding body of research findings, that address the service sector across a scope commensurate with its critical and dominant position in the U.S. economy by applying the rigorous computational problem-solving techniques of engineering and science to improve the quality, productivity, safety, reliability and competitiveness of service operations.

The next step is this solicitation seeking proposals for exploratory research to pursue opportunities for extending engineering- and science-oriented tools and approaches to newly emerging types of service enterprises and those where it has been relatively under-utilized, seek out new ideas about more established service engineering research topics, and begin building an understanding of issues and opportunities common to different types of service operations. *Awards will be limited to \$100K (\$150K for investigator teams), and durations of 18 months* in the interest of gaining the widest possible participation and directing grants to lines of investigation that are new and distinguishable from ongoing efforts already sponsored by NSF or other agencies.

The breadth and variety of aspects of the service economy offer a host of industrial and governmental operations on which research under this solicitation might focus. These include, but are not limited to transportation, logistics (forward and reverse), construction, public utility and infrastructure systems, equipment and product maintenance and repair, health care delivery, finance and insurance, retail, hospitality and entertainment, and a variety of classic government services. However, *the education, energy marketing and distribution, and software development and maintenance sectors are explicitly excluded* because they are already the subject of major NSF investments elsewhere.

II. PROGRAM DESCRIPTION

Proposals are sought that explore novel lines of basic research that promise to extend the range of focused empirical, analytical and computational techniques for design, planning and control of service products, operations and processes, and/or advance policy insights with relevance to implementable solutions in service enterprises. These could include, but are not limited to modeling and representation of processes, data gathering and exploitation, methods and metrics for assessment, and decision tools for planning and control. Some issues will parallel those already dealt with successfully in manufacturing, and creative adaptations of corresponding tools and concepts may prove fruitful. Other lines of investigation will be unique to services or particular sectors. Analysis and computation with operations models will be at the heart of the research effort, but behavioral, economic, mathematical and statistical issues will be central to some topics.

Topics. Any exploratory research addressed to this broad agenda may be appropriate for support under the initiative. Emphasis is on novel and high risk ideas with the potential for high payoff. Some topics appear worthy of special attention because of unique characteristics of service activities.

- The dynamic, demand-responsive nature of many services makes the *modeling and decision making under uncertainty* significantly more critical than in manufacturing settings where production is often preplanned to exploit economies of scale in closed physical environments. Specific topics range from optimal resource allocation and scheduling in settings with high uncertainty and no service inventories, to price and revenue optimization across time and classes of customers, to instruments and markets for management of financial risk.
- *Service network safety, security, reliability and control* are central to many enterprises that must coordinate a variety of resources to fulfill customer needs ranging from the straight-forward to the highly complex, and confront periods of excess demand, crippled operations or safety risks leading to massive congestion and delays, and the prospect of perverse system interactions with calamitous consequences. Research is needed on techniques for avoiding, predicting, controlling, and recovering from serious capacity losses, market disruptions, demand overloads, and threats to security.
- *Location, allocation and coordination* of service operations at different facilities are also important issues, including the efficient matching of staff skills and training to handle the spectrum of customer needs and decision mechanisms for win-win collaborations among providers with different objectives, as well as the management of large service endeavors such as construction projects.

- *Process and product design and definition* are difficult in many settings, particularly where the delivered service is customized for each sale (e.g., construction), initiated by a diagnosis phase before service delivery (e.g. equipment repair) or structured around the active participation of the customer (e.g., medical treatment). New insights and models are needed to find parsimonious descriptions of such processes and products that facilitate evaluation of alternative designs and planning for needed delivery support. In many cases this will require development and incorporation of behavioral models of customer decision making.
- The less standardized and subjective nature of services make *quality and reliability measurement and management* critical issues. Metrics and models of quality and reliability must be derived that provide sound quantitative bases for product and operations design and control, taking into account as appropriate empirically based insights about customer preferences. Concepts of quality management at every stage of production, which have proved tremendously effective in manufacturing settings, may also be adaptable to improve both quality, safety and efficiency of service operations.
- Data from sensors and activity processing is pervasive in many service settings, but its effective use in improving quality and productivity requires focused new tools for *data collection design, data management and data mining*. Issues include modeling and suppression of widespread errors known to permeate operational data, placement and function of system state and health monitoring systems, and estimation of the values that are critical for design, planning and control through the fog of massive data sets and in the presence of dynamic change with improving information over time.

Distinguishable Research Efforts: The limited funds and exploratory goal of this ESS initiative make it essential that proposed research involve lines of investigation that are new and distinguishable from ongoing efforts -- especially from research activities already sponsored by NSF and other agencies. Promising ideas and topics that have not been fully explored are welcome from all qualified researchers. ESS support should not be sought simply to better fund research efforts that are already well established.

Subsequent Support: Awards under the ESS solicitation are expected to explore novel ideas with the potential for high payoff. Because the grants will be limited in budget and duration, it is recognized that many topics may justify subsequent investigation. Such follow-on research in operations modeling and analysis topics could prove to be of interest to the permanent Service Enterprise Engineering (SEE) program being established in the Engineering Directorate Division of Design, Manufacture and Industrial Innovation (DMII) which will begin full operation October 1, 2002. Other aspects could fall within regular programs in the respective NSF divisions joining in the ESS solicitation, or be cofunded by two or more of the ESS participants on a case-by-case basis. However, there is no direct linkage or other assurance of subsequent funding of any topic. ESS researchers are expected to seek research results that have free-standing value independent of future grants. Furthermore, research teams should be sized for the scope of the project proposed under ESS rather than anticipated follow-on activity.

Progress Workshop: One goal of this effort is to stimulate the development of a community of academic researchers in engineering and allied branches of the mathematical and social sciences research working together on tools and methods for engineering the service sector. To that end all grantees will be expected to budget funds for and present their progress in a workshop held in connection with the annual NSF Design, Service and Manufacturing Grantees & Research Conference in January 2004. The location of this conference, which is presently undetermined, will be communicated to all awardees in early 2003.

III. ELIGIBILITY INFORMATION

Proposals may be submitted by U.S. academic institutions eligible under the NSF *Grant Proposal Guide* (http://www.nsf.gov/pubs/2001/nsf012/nsf0102_1.html#whomaysubmit) in support of individual investigators or small groups. Synergistic partnerships with industries and related institutions are encouraged when appropriate; however, NSF awards will be made only to U.S. academic institutions.

IV. AWARD INFORMATION

The program budget, number of awards and average award size/duration are subject to the availability in FY2002 of funds and the quality of the proposals received. However, approximately \$3.0M is expected to be awarded in standard grants of up to \$100K (\$150K for investigator teams) with durations of 18 months.

V. PROPOSAL PREPARATION AND SUBMISSION INSTRUCTIONS

A. Proposal Preparation Instructions

Full Proposal:

Proposals submitted in response to this program announcement/solicitation should be prepared and submitted in accordance with the general guidelines contained in the NSF *Grant Proposal Guide* (GPG). The complete text of the GPG is available electronically on the NSF Web Site at: <http://www.nsf.gov/cgi-bin/getpub?gpg>. Paper copies of the GPG may be obtained from the NSF Publications Clearinghouse, telephone (703) 292-7827 or by e-mail from pubs@nsf.gov.

Proposers are reminded to identify the program solicitation number (NSF 02-029) in the program announcement/solicitation block on the NSF Form 1207, *Cover Sheet For Proposal to the National Science Foundation*. Compliance with this requirement is critical to determining the relevant proposal processing guidelines. Failure to submit this information may delay processing.

B. Budgetary Information

Cost sharing is not required in proposals submitted under this Program Announcement.

C. Deadline/Target Dates

Proposals must be submitted by the following date(s):

Full Proposals by 5:00 PM local time: March 5, 2002

D. FastLane Requirements

Proposers are required to prepare and submit all proposals for this Program Announcement through the FastLane system. Detailed instructions for proposal preparation and submission via FastLane are available at: <http://www.fastlane.nsf.gov/a1/newstan.htm>. For FastLane user support, call 1-800-673-6188 or e-mail fastlane@nsf.gov.

Submission of Electronically Signed Cover Sheets. The Authorized Organizational Representative (AOR) must electronically sign the proposal Cover Sheet to submit the required proposal certifications (see [Chapter II, Section C](#) of the Grant Proposal Guide for a listing of the certifications). The AOR must provide the required certifications within five working days following the electronic submission of the proposal. Further instructions regarding this process are available on the FastLane website at: <http://www.fastlane.nsf.gov>.

VI. PROPOSAL REVIEW INFORMATION

A. NSF Proposal Review Process

Reviews of proposals submitted to NSF are solicited from peers with expertise in the substantive area of the proposed research or education project. These reviewers are selected by Program Officers charged with the oversight of the review process. NSF invites the proposer to suggest, at the time of submission, the names of appropriate or inappropriate reviewers. Care is taken to ensure that reviewers have no conflicts with the proposer. Special efforts are made to recruit reviewers from non-academic institutions, minority-serving institutions, or adjacent disciplines to that principally addressed in the proposal.

Proposals will be reviewed against the following general review criteria established by the National Science Board. Following each criterion are potential considerations that the reviewer may employ in the evaluation. These are suggestions and not all will apply to any given proposal. Proposers are reminded that both the intellectual merit and the broader impacts of the work to be accomplished should be addressed. While reviewers are expected to address both merit review criteria, each reviewer will be asked to address only considerations that are relevant to the proposal and for which he/she is qualified to make judgements.

What is the intellectual merit of the proposed activity?

How important is the proposed activity to advancing knowledge and understanding within its own field or across different fields? How well qualified is the proposer (individual or team) to conduct the project? (If appropriate, the reviewer will comment on the quality of the prior work.) To what extent does the proposed activity suggest and explore creative and original concepts? How well conceived and organized is the proposed activity? Is there sufficient access to resources?

What are the broader impacts of the proposed activity?

How well does the activity advance discovery and understanding while promoting teaching, training, and learning? How well does the proposed activity broaden the participation of underrepresented groups (e.g., gender, ethnicity, disability, geographic, etc.)? To what extent will it enhance the infrastructure for research and education, such as facilities, instrumentation, networks, and partnerships? Will the results be disseminated broadly to enhance scientific and technological understanding? What may be the benefits of the proposed activity to society?

Principal Investigators should address the following elements in their proposal to provide reviewers with the information necessary to respond fully to both of the above-described NSF merit review criteria. NSF staff will give these elements careful consideration in making funding decisions.

Integration of Research and Education

One of the principal strategies in support of NSF's goals is to foster integration of research and education through the programs, projects, and activities it supports at academic and research institutions. These institutions provide abundant opportunities where individuals may concurrently assume responsibilities as researchers, educators, and students and where all can engage in joint efforts that infuse education with the excitement of discovery and enrich research through the diversity of learning perspectives.

Integrating Diversity into NSF Programs, Projects, and Activities

Broadening opportunities and enabling the participation of all citizens -- women and men, underrepresented minorities, and persons with disabilities -- is essential to the health and vitality of science and engineering. NSF is committed to this principle of diversity and deems it central to the programs, projects, and activities it considers and supports.

A summary rating and accompanying narrative will be completed and submitted by each reviewer. In all cases, reviews are treated as confidential documents. Verbatim copies of reviews, excluding the names of the reviewers, are sent to the Principal Investigator/Project Director by the Program Director. In addition, the proposer will receive an explanation of the decision to award or decline funding.

B. Review Protocol and Associated Customer Service Standard

All proposals are carefully reviewed by at least three other persons outside NSF who are experts in the particular field represented by the proposal. Proposals submitted in response to this announcement/solicitation will be reviewed by Panel Review.

Reviewers will be asked to formulate a recommendation to either support or decline each proposal. The Program Officer assigned to manage the proposal's review will consider the advice of reviewers and will formulate a recommendation.

NSF is striving to be able to tell applicants whether their proposals have been declined or recommended for funding within six months for 70 percent of proposals. The time interval begins on the date of receipt. The interval ends when the Division Director accepts the Program Officer's recommendation.

In all cases, after programmatic approval has been obtained, the proposals recommended for funding will be forwarded to the Division of Grants and Agreements for review of business, financial, and policy implications and the processing and issuance of a grant or other agreement. Proposers are cautioned that only a Grants and Agreements Officer may make commitments, obligations or awards on behalf of NSF or authorize the expenditure of funds. No commitment on the part of NSF should be inferred from technical or budgetary discussions with a NSF Program Officer. A Principal Investigator or organization that makes financial or personnel commitments in the absence of a grant or cooperative agreement signed by the NSF Grants and Agreements Officer does so at its own risk.

VII. AWARD ADMINISTRATION INFORMATION

A. Notification of the Award

Notification of the award is made to *the submitting organization* by a Grants Officer in the Division of Grants and Agreements. Organizations whose proposals are declined will be advised as promptly as possible by the cognizant NSF Program Division administering the program. Verbatim copies of reviews, not including the identity of the reviewer, will be provided automatically to the Principal Investigator. (See section VI.A. for additional information on the review process.)

B. Award Conditions

An NSF award consists of: (1) the award letter, which includes any special provisions applicable to the award and any numbered amendments thereto; (2) the budget, which indicates the amounts, by categories of expense, on which NSF has based its support (or otherwise communicates any specific approvals or disapprovals of proposed expenditures); (3) the proposal referenced in the award letter; (4) the applicable award conditions, such as Grant General Conditions (NSF-GC-1)* or Federal Demonstration Partnership (FDP) Terms and Conditions;* and (5) any announcement or other NSF issuance that may be incorporated by reference in the award letter. Cooperative agreement awards also are administered in accordance with NSF Cooperative Agreement Terms and Conditions (CA-1). Electronic mail notification is the preferred way to transmit NSF awards to organizations that have electronic mail capabilities and have requested such notification from the Division of Grants and Agreements.

*These documents may be accessed electronically on NSF's Web site at http://www.nsf.gov/home/grants/grants_gac.htm. Paper copies may be obtained from the NSF Publications Clearinghouse, telephone (703) 292-7827 or by e-mail from pubs@nsf.gov.

More comprehensive information on NSF Award Conditions is contained in the NSF *Grant Policy Manual* (GPM) Chapter II, available electronically on the NSF Web site at <http://www.nsf.gov/cgi-bin/getpub?gpm>. The GPM is also for sale through the Superintendent of Documents, Government Printing Office (GPO), Washington, DC 20402. The telephone number at GPO for subscription information is (202) 512-1800. The GPM may be ordered through the GPO Web site at <http://www.gpo.gov>.

C. Reporting Requirements

For all multi-year grants (including both standard and continuing grants), the PI must submit an annual project report to the cognizant Program Officer at least 90 days before the end of the current budget period.

Within 90 days after the expiration of an award, the PI also is required to submit a final project report. Approximately 30 days before expiration, NSF will send a notice to remind the PI of the requirement to file the final project report. Failure to provide final technical reports delays NSF review and processing of pending proposals for that PI. PIs should examine the formats of the required reports in advance to assure availability of required data.

NSF has implemented an electronic project reporting system, available through FastLane. This system permits electronic submission and updating of project reports, including information on project participants (individual and organizational), activities and findings, publications, and other specific products and contributions. PIs will not be required to re-enter information previously provided, either with a proposal or in earlier updates using the electronic system.

VIII. CONTACTS FOR ADDITIONAL INFORMATION

General inquiries regarding Exploratory Research on Engineering the Service Sector should be made to:

- Ronald L. Rardin, Operations Research & Service Enterprise Engineering, Program Director, Engineering, Design, Manufacture & Industrial Innovation, 550, telephone: 703-292-7081, e-mail: rrardin@nsf.gov.
- Miriam Heller, Infrastructure & Information Systems, Program Director, Engineering, Civil & Mechanical Systems, 545, telephone: 703-292-7025, e-mail: mheller@nsf.gov.
- Gilbert B. Devey, Biomedical Engineering, Program Director, Engineering, Bioengineering & Environmental Systems, 565, telephone: 703-292-7943, e-mail: gdevey@nsf.gov.
- Deborah Frisch, Decision Risk & Management Science, Program Director, Social, Behavioral & Economic Sciences, Social and Economic Sciences, 995, telephone: 703-292-7261, e-mail: dfrisch@nsf.gov.
- Deborah Lockhart, Applied Mathematics, Program Director, Mathematics & Physical Sciences, Mathematical Sciences, 1025, telephone: 703-292-4858, e-mail: dlockhar@nsf.gov.

- Tom Fogwell, Applied Mathematics & Computational Mathematics, Program Director, Mathematics & Physical Sciences, Mathematical Sciences, 1025, telephone: 703-292-8104, e-mail: tfogwell@nsf.gov.
- Marianthi Markatou, Statistics & Probability, Program Director, Mathematics & Physical Sciences, Mathematical Sciences, 1025, telephone: 703-292-4863, e-mail: mmarkato@nsf.gov.

For questions related to the use of FastLane, contact:

- None Specified

IX. OTHER PROGRAMS OF INTEREST

The NSF *Guide to Programs* is a compilation of funding for research and education in science, mathematics, and engineering. The NSF *Guide to Programs* is available electronically at <http://www.nsf.gov/cgi-bin/getpub?gp>. General descriptions of NSF programs, research areas, and eligibility information for proposal submission are provided in each chapter.

Many NSF programs offer announcements or solicitations concerning specific proposal requirements. To obtain additional information about these requirements, contact the appropriate NSF program offices. Any changes in NSF's fiscal year programs occurring after press time for the *Guide to Programs* will be announced in the NSF [E-Bulletin](#), which is updated daily on the NSF web site at <http://www.nsf.gov/home/ebulletin>, and in individual program announcements/solicitations. Subscribers can also sign up for NSF's [Custom News Service](#) (<http://www.nsf.gov/home/cns/start.htm>) to be notified of new funding opportunities that become available.

ABOUT THE NATIONAL SCIENCE FOUNDATION

The National Science Foundation (NSF) funds research and education in most fields of science and engineering. Awardees are wholly responsible for conducting their project activities and preparing the results for publication. Thus, the Foundation does not assume responsibility for such findings or their interpretation.

NSF welcomes proposals from all qualified scientists, engineers and educators. The Foundation strongly encourages women, minorities and persons with disabilities to compete fully in its programs. In accordance with Federal statutes, regulations and NSF policies, no person on grounds of race, color, age, sex, national origin or disability shall be excluded from participation in, be denied the benefits of, or be subjected to discrimination under any program or activity receiving financial assistance from NSF (unless otherwise specified in the eligibility requirements for a particular program).

Facilitation Awards for Scientists and Engineers with Disabilities (FASSED) provide funding for special assistance or equipment to enable persons with disabilities (investigators and other staff, including student research assistants) to work on NSF-supported projects. See the program announcement/solicitation for further information.

The National Science Foundation has Telephonic Device for the Deaf (TDD) and Federal Information Relay Service (FIRS) capabilities that enable individuals with hearing impairments to communicate with the Foundation about NSF programs, employment or general information. TDD may be accessed at (703) 292-5090 or (800) 281-8749, FIRS at 1-800-877-8339.

The National Science Foundation is committed to making all of the information we publish easy to understand. If you have a suggestion about how to improve the clarity of this document or other NSF-published materials, please contact us at plainlanguage@nsf.gov.

PRIVACY ACT AND PUBLIC BURDEN STATEMENTS

The information requested on proposal forms and project reports is solicited under the authority of the National Science Foundation Act of 1950, as amended. The information on proposal forms will be used in connection with the selection of qualified proposals; project reports submitted by awardees will be used for program evaluation and reporting within the Executive Branch and to Congress. The information requested may be disclosed to qualified reviewers and staff assistants as part of the proposal review process; to applicant institutions/grantees to provide or obtain data regarding the proposal review process, award decisions, or the administration of awards; to government contractors, experts, volunteers and researchers and educators as necessary to complete assigned work; to other government agencies needing information as part of the review process or in order to coordinate programs; and to another Federal agency, court or party in a court or Federal administrative proceeding if the government is a party. Information about Principal Investigators may be added to the Reviewer file and used to select potential candidates to serve as peer reviewers or advisory committee members. See Systems of Records, NSF-50, "Principal Investigator/Proposal File and Associated Records," 63 Federal Register 267 (January 5, 1998), and NSF-51, "Reviewer/Proposal File and Associated Records," 63 Federal Register 268 (January 5, 1998). Submission of the information is voluntary. Failure to provide full and complete information, however, may reduce the possibility of receiving an award.

Pursuant to 5 CFR 1320.5(b), an agency may not conduct or sponsor, and a person is not required to respond to an information collection unless it displays a valid OMB control number. The OMB control number for this collection is 3145-0058. Public reporting burden for this collection of information is estimated to average 120 hours per response, including the time for reviewing instructions. Send comments regarding this burden estimate and any other aspect of this collection of information, including suggestions for reducing this burden, to: Suzanne Plimpton, Reports Clearance Officer, Information Dissemination Branch, Division of Administrative Services, National Science Foundation, Arlington, VA 22230, or to Office of Information and Regulatory Affairs of OMB, Attention: Desk Officer for National Science Foundation (3145-0058), 725 17th Street, N.W. Room 10235, Washington, D.C. 20503.

OMB control number: 3145-0058.